

A1
Concl.

watermark area of said digital data contents;

calculating the number k_i of '1' or '0' included in said digital watermark sequence;

calculating a probability $F(k_i)$ by using said binary distribution function $F(x)$; and

reconstituting '1' or '0' from i th digital watermark data w_i if $F(k_i) > \alpha$, reconstituting '0' or '1' from i th digital watermark data w_i if $1-F(k_i) > \alpha$, and determining that there is no watermark data or the presence is unknown if both of $F(k_i) > \alpha$ and $1-F(k_i) > \alpha$ are not satisfied.

A2

3. ~~28~~. (Amended) A method for reading digital watermark data embedded in digital data contents, said method comprising the steps of:

receiving said digital data contents;

determining a threshold α of reliability of digital watermark data which is read;

obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold α by using said binary distribution function $F(x)$; and

reconstituting digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds α , and determining that there is no watermark data or the presence is unknown if said probability does not exceed α .

A3

5. ~~30~~. (Amended) The method as claimed in claim ~~26~~, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said method further comprising the steps of:

demodulating said digital watermark sequence by said pseudo-random sequence; and

reconstituting digital watermark data from said demodulated digital watermark sequence.

6. ~~31~~. (Amended) A method for reading digital watermark data embedded in digital data

A3
Continuous

contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said method comprising the steps of:

receiving said digital data contents;

determining a threshold α of reliability of digital watermark data which is read;

obtaining a binary distribution function $F(x)$ which represents a probability that a number of x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

demodulating said digital watermark sequence by said pseudo-random sequence;

assigning $\frac{1}{2}$ to said probability q ;

obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ and a minimum number x_1 which satisfies $\alpha \leq F(x=x_1) \leq 1$;

obtaining the number k_i of '1' or '0' included in said i th digital watermark sequence;
and

reconstituting i th digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and reconstituting said i th digital watermark data w_i as '1' or '0' if $k_i \geq x_1$.

1. 32. (Amended) A method for reading digital watermark data embedded in digital data contents; if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said method comprising the steps of:

receiving said digital data contents;

determining a threshold α of reliability of digital watermark data which is read;

obtaining a binary distribution function $F(x)$ which represents a probability that x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

demodulating said digital watermark sequence by said pseudo-random sequence;

A3
Concl.

assigning $\frac{1}{2}$ to said probability q ;

obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ or $\alpha \leq F(x=x_1) \leq 1$;

determining whether a value is equal to or less than x_0 or equal to or more than x_1 , said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said i th digital watermark sequence and a central value q of a binary distribution;

reconstituting digital watermark data by performing majority decision processing for said i th digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1 ; and

determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1 .

A4

9. ~~35.~~ (Amended) An apparatus for reading digital watermark data embedded in digital data contents, said apparatus comprising;

means for receiving said digital data contents;

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for calculating the number k_i of '1' or '0' included in said digital watermark sequence;

means for calculating a probability $F(k_i)$ by using said binary distribution function $F(x)$; and

means for reconstituting '1' or '0' from i th digital watermark data w_i if $F(k_i) > \alpha$, reconstituting '0' or '1' from i th digital watermark data w_i if $1-F(k_i) > \alpha$, and, determining that there is no watermark data or the presence is unknown if both of $F(k_i) > \alpha$ and $1-F(k_i) > \alpha$ are not satisfied, α being a threshold of reliability of digital watermark data which is read.

A5

11. ~~37.~~ (Amended) An apparatus for reading digital watermark data embedded in digital

A5
Concl.

data contents, said apparatus comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold α by using said binary distribution function $F(x)$, α being a threshold of reliability of digital watermark data which is read; and

means for reconstituting and generating digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds α , and, determining that there is no watermark data or the presence is unknown if said probability does not exceed α .

A6

13. 39. (Amended) The apparatus as claimed in claim 38, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said apparatus further comprising:

means for demodulating said digital watermark sequence by said pseudo-random sequence; and

means for reconstituting digital watermark data from said demodulated digital watermark sequence.

14. 40. (Amended) An apparatus for reading digital watermark data embedded in digital data contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said apparatus comprising:

means for receiving said digital data contents:

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding

each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning $\frac{1}{2}$ to said probability q ;

means for obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ and a minimum number x_1 which satisfies $\alpha \leq F(x=x_1) \leq 1$, α being a threshold of reliability of digital watermark data which is read;

means for obtaining the number k_i of '1' or '0' included in said i th digital watermark sequence; and

means for reconstituting i th digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and, reconstituting said i th digital watermark data w_i as '1' or '0' if $k_i \geq x_1$.

15.41. (Amended) An apparatus for reading digital watermark data embedded in digital data contents:, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said apparatus comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning $\frac{1}{2}$ to said probability q ;

means for obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ or $\alpha \leq F(x=x_1) \leq 1$, α being a threshold of reliability of digital watermark data which is read;

means for determining whether a value is equal to or less than x_0 or equal to or more than x_1 , said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said i th digital watermark sequence and a central value $q \times t$ of a

AP
Concl

binary distribution;

means for reconstituting digital watermark data by performing majority decision processing for said i th digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1 ; and

means for determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1 .

A.7

17.44. (Amended) An integrated circuit for reading digital watermark data embedded in digital data contents, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for calculating the number k_i of '1' or '0' included in said digital watermark sequence;

means for calculating a probability $F(k_i)$ by using said binary distribution function $F(x)$; and

means for reconstituting '1' or '0' from i th digital watermark data w_i if $F(k_i) > \alpha$, reconstituting '0' or '1' from i th digital watermark data w_i if $1 - F(k_i) > \alpha$, and determining that there is no watermark data or the presence is unknown if both of $F(k_i) > \alpha$ and $1 - F(k_i) > \alpha$ are not satisfied, α being a threshold of reliability of digital watermark data which is read.

A.8

17.45. (Amended) An integrated circuit for reading digital watermark data embedded in digital data contents, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number of x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of

A8
Concl.

embedding each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold α by using said binary distribution function $F(x)$, α being a threshold of reliability of digital watermark data which is read; and

means for reconstituting and generating digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds α , and, determining that there is no watermark data or the presence is unknown if said probability does not exceed α .

A9

~~21.48~~¹⁷. (Amended) The integrated circuit as claimed in claim ~~44~~¹⁷, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said integrated circuit further comprising:

means for demodulating said digital watermark sequence by said pseudo-random sequence; and

means for reconstituting digital watermark data from said demodulated digital watermark sequence.

~~22.49~~¹⁷. (Amended) An integrated circuit for reading digital watermark data embedded in digital data contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning $\frac{1}{2}$ to said probability q ;

A9
Concl.

means for obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ and a minimum number x_1 which satisfies $\alpha \leq F(x=x_1) \leq 1$, α being a threshold of reliability of digital watermark data which is read; and

means for obtaining the number k_i of '1' or '0' included in said i th digital watermark sequence;

means for reconstituting i th digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and, reconstituting said i th digital watermark data w_i as '1' or '0' if $k_i \leq x_1$.

23/50 (Amended) An integrated circuit for reading digital watermark data embedded in digital data contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning $1/2$ to said probability q ;

means for obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ or $\alpha \leq F(x=x_1) \leq 1$, α being a threshold of reliability of digital watermark data which is read;

means for determining whether a value is equal to or less than x_0 or equal to or more than x_1 , said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said i th digital watermark sequence and a central value $q \times t$ of a binary distribution;

means for reconstituting digital watermark data by performing majority decision processing for said i th digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1 ; and

means for determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1 .

A 10

25/53

(Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability a of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

program code means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

program code means for calculating the number k_i of '1' or '0' included in said digital watermark sequence; and

program code means for calculating a probability $F(k_i)$ by using said binary distribution function $F(x)$;

program code means for reconstituting '1' or '0' from i th digital watermark data w_i if $F(k_i) > \alpha$, reconstituting '0' or '1' from i th digital watermark data w_i if $1 - F(k_i) > \alpha$, and, determining that there is no watermark data or the presence is unknown if both of $F(k_i) > \alpha$ and $1 - F(k_i) > \alpha$ are not satisfied, α being a threshold of reliability of digital watermark data which is read.

A 11

27/55

(Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability a of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

program code means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

A 11
Cncl.

program code means for checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold α by rising said binary distribution function $F(x)$, α being a threshold of reliability of digital watermark data which is read; and

program code means for reconstituting and generating digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds α , and determining that there is no watermark data or the presence is unknown if said probability does not exceed α .

A 10

~~29~~²⁵ 25. (Amended) The computer readable medium as claimed in claim ~~53~~²⁵, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said computer readable medium further comprising:

program code means for demodulating said digital watermark sequence by said pseudo-random sequence; and

program code means for reconstituting digital watermark data from said demodulated digital watermark sequence.

~~30~~³⁰ 30. (Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, if data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function. $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

program code means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

program code means for demodulating said digital watermark sequence by said pseudo-random sequence;

program code means for assigning $\frac{1}{2}$ to said probability q ;

program code means for obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ and a minimum number x_1 which satisfies $\alpha \leq F(x=x_1) \leq 1$, α being a

A/2
Concl.

threshold of reliability of digital watermark data which is read; and

program code means for obtaining the number k_i of '1' or '0' included in said i th digital watermark sequence;

program code means for reconstituting i th digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and, reconstituting said i th digital watermark data w_i as '1' or '0' if $k_i \leq x_1$.

3159. (Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, if data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function $F(x)$ which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function $F(x)$ being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

program code means for reading an i th digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

program code means for demodulating said digital watermark sequence by said pseudo-random sequence;

program code means for assigning $1/2$ to said probability q ;

program code means for obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\alpha$ or $\alpha \leq F(x=x_1) \leq 1$, α being a threshold of reliability of digital watermark data which is read;

program code means for determining whether a value is equal to or less than x_0 or equal to or more than x_1 , said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said i th digital watermark sequence and a central value $q \times t$ of a binary distribution;

program code means for reconstituting digital watermark data by performing majority decision processing for said i th digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1 ; and

program code means for determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1 .